Check List the journal of biodiversity data

NOTES ON GEOGRAPHIC DISTRIBUTION

Check List 13(3): 2142, 14 June 2017 https://doi.org/10.15560/13.3.2142
ISSN 1809-127X © 2017 Check List and Authors

A new locality in Paraguay for the Black-tailed Marmoset, *Mico melanurus* (Geoffroy Saint-Hilaire, 1812) (Primates, Callitrichidae)

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Abstract. *Mico melanurus* is an endangered primate in Paraguay, with most Paraguayan records in the vicinity of Agua Dulce (Defensores del Chaco National Park). We report the first well-documented locality outside of the Agua Dulce/ Linea 1 transect, representing the most northeastern record in Paraguay, as well as a new habitat for the species, transitional Pantanal-Cerrado. This note demonstrates the importance of monitoring areas which have been insufficiently studied for conservation purposes.

Key words. Chaco; *Mico melanurus*; new record; transitional Pantanal-Cerrado.

Paraguay harbors 5 species of primates: the Southern Black Howler (*Alouatta caraya*), Azara's Capuchin (*Sapajus cay*), Azara's Night Monkey (*Aotus azarae*), Pale-mantled Titi (*Callicebus pallescens*) and Black-tailed Marmoset (*Mico melanurus*) (Stallings 1989, Stallings et al. 1989, Brooks 1996, Smith 2010). The largest species, *A. caraya*, is found mostly along rivers in the Oriente (that part of the country east of the Paraguay River) as well as palm savannahs in the lower Chaco, although it does get into higher vegetation in the northeastern Chaco (Stallings et al. 1989). Another large species, *S. cay*, is found mostly in the northern and central Orient (Stallings 1989, Stallings et al. 1989). The 2 medium-sized species, *A. azarae* and *C. pallescens*, are found throughout most of the Chaco and northeastern xeric Chaco, respectively (Stallings 1989, Stallings et al. 1989, Brooks 1996).

The smallest species, *M. melanurus*, is restricted to the extreme northeastern Chaco (Stallings & Mittermeier 1983). This species was formerly considered a subspecies of the Silvery Marmoset (*M. argentatus*) until elevated to full species status by de Vivo (1991).

The majority of sightings of *M. melanurus* in Paraguay have been in the vicinity of Agua Dulce (Defensores del Chaco National Park, Departamento de Alto Paraguay), between the ranger station and a swath of forest extending 3 km to the east (Table 1). The frequency of these sightings were largely bimodal, taking place during the early 1980s (Stallings & Mittermeier 1983), and again between 2007 and 2010 (Smith 2010, Giordano, pers. comm.).

While *M. melanurus* has been reported by interviewees further north and east of Agua Dulce (Brooks 1996), direct encounters have been documented at only a couple of localities. Stallings & Mittermeier (1983) observed *M. melanurus* east of Agua Dulce along Linea 1 (the same latitude as Agua Dulce, 20° S) at km 30 and 48, and up to 14 km south of km 48 (Fig. 1). During primate surveys in the northern Chaco in July 1990, Brooks (1996) only accounted for the 2 medium-sized species (*C. pallescens* and *A. azarae*) but not *M. melanurus*, although the area covered was west of Agua Dulce where it had not been recorded.

Herein we report a new record of *M. melanurus* in Paraguay well east and north of Agua Dulce, which also represents a new habitat recorded for this endangered Paraguayan primate (SEAM 2006). We briefly address the results in light of current habitat threats in the region, as land use changes are rapidly affecting Paraguayan wilderness before we have a firm understanding of what is being lost.

Current distribution of *M. melanurus* within and near Paraguay (Fig. 1, Table 1) was documented through literature review, and perusing museum database records for American Museum of Natural History (AMNH), Field Museum (FMNH), National Museum of Natural History (NMNH), University of Michigan Museum of Zoology (UMMZ) and VertNet (databases accessed 25 July 2016). These localities were compared to the site of the observation reported below

On 20 July of 2016, HCB, LRN and DB were driving south on Linea 28 in a pickup truck at 60–70 km/hr, ca. 20 km west of Mbarigui (Departamento de Alto Chaco, Paraguay; 19°47′38.95″ S, 058°48′07.73″ W). At 09:15 hr a group of 3 *M. melanurus* was observed running towards the road quadrupedally from the right side to cross to a large tree on the left. As the vehicle approached rapidly the marmosets split off (2 crossed

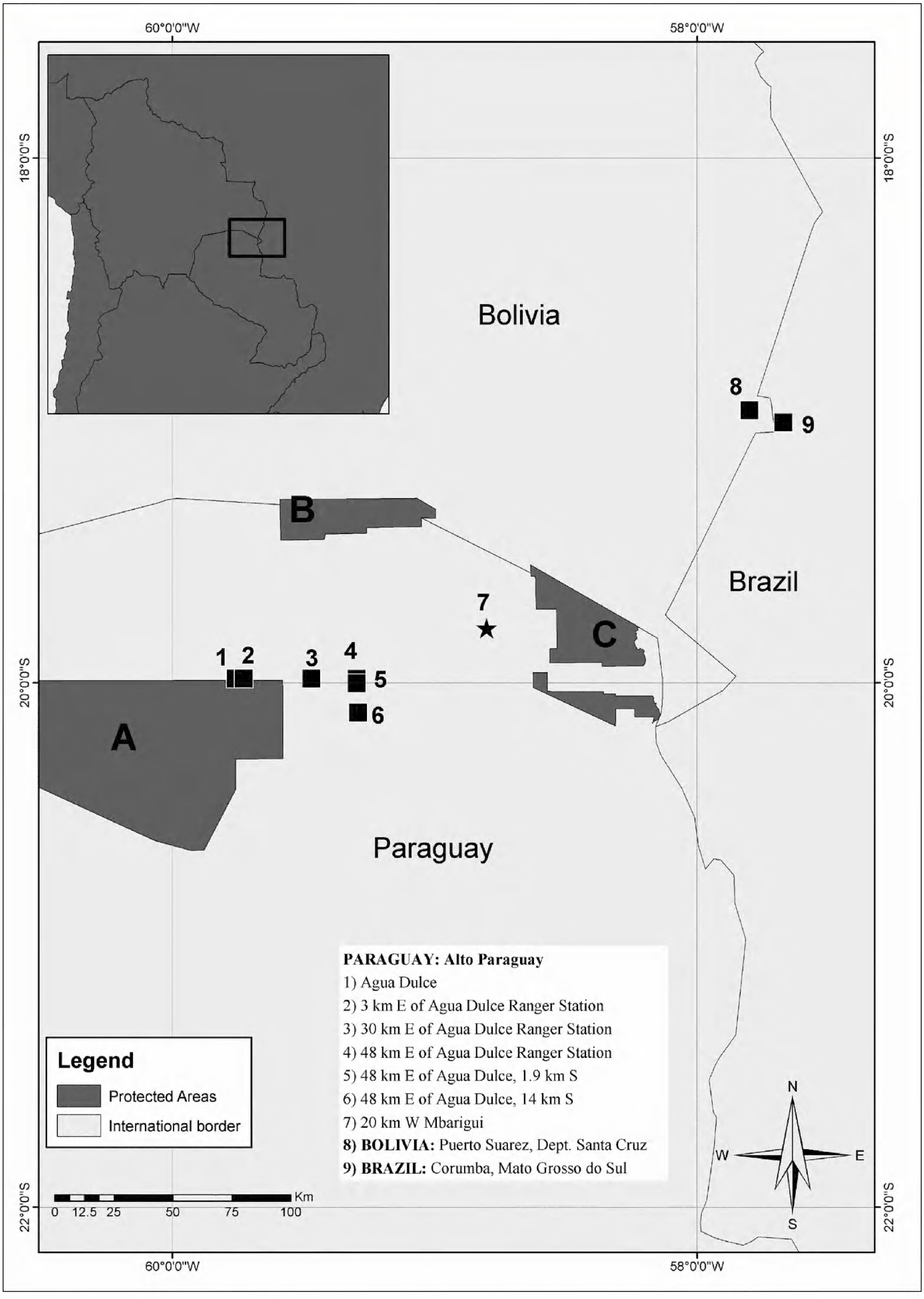

Figure 1. Map depicting known localities of *Mico melanurus* (squares) and the new locality (star). Protected areas include (A) Defensores del Chaco National Park, (B) Chovoreca National Park, and (C) Río Negro National Park.

Table 1. Site, date, collector and reference of sightings of *Mico melanurus* in the Paraguan Chaco, presented west to east and south to north.

Site	Date	Data Collector	Reference
Paraguay: Alto Paraguay			
PN Defensores del Chaco, Agua Dulce	1981	J. Stallings	Stallings & Mittermeier 1983
PN Defensores del Chaco, Agua Dulce	Nov. 2010	P. Smith	Smith 2010
Agua Dulce, ~2 km E of Ranger Station	Jul. 2007	A. Giordano	pers. comm.
Agua Dulce, ~2 km E of Ranger Station	Aug. 2008	A. Giordano	pers. comm.
Agua Dulce, 3 km E on Linea 1	Jun. 1981	J. Stallings	NMNH 555657; Stallings & Mittermeier 1983
Agua Dulce, 30 km E on Linea 1	1981	J. Stallings	Stallings & Mittermeier 1983
Agua Dulce, 48 km E on Linea 1	Jul. 1981	J. Stallings	UMMZ 158045; Stallings & Mittermeier 1983
Agua Dulce, 48 km E on Linea 1, 1.9 km S	1981	J. Stallings	Stallings & Mittermeier 1983
Agua Dulce, 48 km E on Linea 1, 14 km S	1981	J. Stallings	Stallings & Mittermeier 1983
Mbarigui, 20 km W	Jul. 2016	HECB, LRN, DB	Reported herein
Paraguay River	1852	T.J. Page	NMNH 3353
Bolivia: Santa Cruz			
Puerto Suarez			Anderson 1997
Brazil: Mato Grosso do Sul			
Corumba	Nov. 1913	L.E. Miller	AMNH 37059-37062

Figure 2. Photograph of *Mico melanurus* reported herein (photo by L. Romero-N.).

Figure 3. Original specimen tag of NMNH 3353, by T. J. Page (photo by D.M. Brooks).

the road to the left of vehicle, 1 remained on the right). The vehicle was immediately stopped and the observers got out to search the area, whereupon 2 additional marmosets were spotted 4 m off the ground in a tall tree (ca. 10 m high) to the left. The marmoset troop quickly climbed higher into a stand of *Peltophorum dubium* trees, where one of the individuals remained long enough to be observed for 15 min. (Fig. 2), before it also fled deeper into the forest to join the rest of the troop.

The habitat was transitional Pantanal-Cerrado (Mereles et al. 2013). The dirt road was 4 m wide, flanked by a 4 m wide swath of short grasses (≤ 5–7 cm high) on both sides of the road, which transitioned into taller savannah (≤ 1.7 m high) that was ca. 8 and 10 m wide on the left and right side, respectively. Typical Cerrado woodland was on the right side of this ca. 30 m gap, and taller forest (10–12 m high) was on the left. Cerrado is comprised of a mixture of open vegetation with isolated trees and island forest (Mereles et al. 2013). As the vehicle was traveling between study sites, no other species of primates were recorded.

With Paraguay's arboreal mammalian fauna relatively depauperate compared to more tropical areas closer to the equator, it is difficult to confuse *M. melanurus* with other species. The pelage and size of the primates observed (Fig. 2) clearly matched that of *M. melanurus*, with the upper torso being silvery-gray, becoming darker towards distal extremities of appendages, with a dark face, legs and tail; hip stripes; unpigmented nose and ears without tufts (de Vivo 1991). These characteristics matched museum specimens examined at NMNH by DMB, as well as photographs in Stallings (1989) and Smith (2010).

This record is noteworthy, as it is the first well-documented locality for *M. melanurus* outside of the Agua Dulce/Linea 1 transect in Paraguay (23 km north, and 52 km east). A specimen at the National Musuem of Natural History (NMNH 3353) was collected by T.J. Page purportedly along the "Paraguay River" in 1852 (Table 1, Fig. 3). It is possible that this specimen was actually collected along the Paraguay River, but during that era it was common to create multiple tags for a base camp, the locality of which was assigned to all specimens, regardless of where they were collected. As T.J. Page did not provide the precise collection locality for this sample, it is impossible to

determine if the specimen was from the Agua Dulce/Linea 1 transect, or transitional Pantanal/Cerrado region.

Stallings & Mittermeier (1983) reported that *M. melanurus* is restricted to Dry Chaco forest having a canopy that is mostly 5–10 m high along Linea 1 and 20–25 m high at localities south of Linea 1 where some emergent trees reach 30 m in height. The new locality is transitional habitat between Pantanal and Cerrado (Mereles et al. 2013). While *M. melanurus* has been reported to occur in other habitats, including near the study area in eastern Bolivia (Brooks et al. 2002), this is the first time it has been recorded in transitional Pantanal-Cerrado vegetation in Paraguay. There was a gap of ca. 30 m between forest patches, dictating the marmosets travel quadrupedally on the ground. Crossing wide gaps on the ground has been inferred in at least 1 other case for a Paraguayan primate (Giordano & Ballard 2010).

This region harbors other rare species as well. For example, a flock of 3 Red-and-green Macaws (*Ara chloroptera*) were recorded in the vicinity on the same day as the marmoset (HCB, LRN and DB unpubl. data). Additionally, this new marmoset record demonstrates the importance of monitoring areas which have been insufficiently studied. This area is located within a region of rapid land use changes which affect the area, particularly the Gran Chaco ecoregion (Hansen et al. 2013, Yanosky 2013). This transitional area is characterized by escalating deforestation patterns from pristine forests to grazing lands for livestock production (Hansen et al. 2013, Caballero et al. 2014, Pizzurno et al. 2014). Government plans and regional prioritization indicate the area will soon be transformed with new roads and other infrastructure. The observation herein provides information for decision making, in terms of mitigating loss of natural habitat and pertinent planning for compensation measures (Cardozo et al. 2013).

ACKNOWLEDGEMENTS

We would like to thank the people of Estancia Chovoreca. HCB, DB and AY would like to thank Comisión Nacional de Ciencias y Tecnología (CONACYT) through the Programa Nacional de Incentivo a Investigadores (PRONII) and Programa Paraguayo para el desarrollo de la ciencia y tecnología (PROCIENCIA) for financial support of project PINV 063. DMB thanks D. Lunde for providing access to specimens housed at NMNH.

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Authors' contributions. HCB, LRN and DB made the observation and provided information for the ms, DMB wrote the text, AY contributed to the Discussion, and all authors commented on the final draft.

Received: 22 September 2016
Accepted: 4 May 2017
Academic editor: Átilla Colombo Ferreguetti